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(54) PROCESS FOR THE PRODUCTION OF WAX

(71) We, HENRY MOUTRAY COMPANY LIMITED, a company organised and existing under the laws of the Republic of Ireland of Tankardstown House, Donaghpatrick, Navan, Co. Meath, Republic of Ireland, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to chemical processes and in particular to the production of wax materials. The invention has as an object a method of obtaining hydrocarbon waxes. A further object is the manufacture of new and useful hydrocarbon products from waste polymers of ethylene.

The process of the invention uses as starting materials the high molecular weight polymers obtained by polymerising ethylene alone or in admixture with at least one other polymerisable compound. The polymers of ethylene are known commercially as polyethylene or polythene and also by other commercial or trade names. They are obtained as so called low density or high density materials depending on their method of manufacture. These methods may be by high pressure polymerisation at pressures about 1000 atmospheres or under low pressures by the Ziegler process.

Polythene or polyethylene of commerce is used in large tonnage quantities particularly as a packaging material as film or as manufactured articles including moulded articles such as bottles. The discarded packaging is a serious pollutant. It is an object of material for the purpose of making a useful product and so to yield a useful method of reducing pollution of the environment.

The present invention provides a process for the production of wax materials from polymers of ethylene in which the polymeric materials are pyrolysed at temperatures in excess of 350°C in an atmosphere of steam to produce soft greases, which are carried off in the steam, and wax materials.

In a preferred embodiment, the process is carried out in a pyrolysis vessel charged with wax previously produced by the process, the wax being molten at the pyrolysis temperature. Preferably, the polymeric materials are fed to the pyrolysis vessel, the pyrolysis takes place in the liquid wax phase and wax materials are withdrawn from the vessel, suitably by continuous withdrawal through a valve.

In its preferred embodiment, the process of the invention is described as follows:—

Polythene material shredded or cut into conveniently sized pieces is cracked in a reactor provided with a means of heating and a means of feeding the polythene pieces. An inlet and outlet are provided to allow steam to be passed over the mass in the reactor. The lower portion of the reactor is filled with molten wax prepared by thermal cracking of the polythene. Steam is passed over the surface of the molten mass and air is excluded. Polythene pieces are fed to the reactor through the feeder. The material passes into the molten mass where the cracking reaction takes place. Soft greases are evolved and are carried off in the steam and collected at a steam condenser provided at the steam outlet. A hard brittle odourless colourless wax is formed and remains in the reactor. It can be recovered continuously or in batches through an outlet provided.

The temperature of cracking depends on the grade of polythene used and the nature of the product required, but a useful temperature range is 350°C to 500°C. Preferably the temperature is in excess of 375°C. The reaction time is suitably 10 minutes to 30 minutes. Normally the reactor is operated at atmospheric pressure and the steam used is preferably wet steam free of particulate water which can cause difficulty in operation because of frothing in the reactor. Preferably the steam is passed continuously through the pyrolysis vessel. The polythene may suitably be "low density" polythene, the specific gravity of which is in the range of 0.90—0.94, or "high density" polythene, the specific gravity of which is in the range 0.94—0.96.

The soft grease volatilised with the steam has a pungent odour and is useful as a petroleum substitute.

The residual waxes which may be re-

garded as medium-weight polyethylenes are hard and brittle with a melting range from 90°C to 100°C. They are useful as constituents of polishes and in paper coating formulations. They may be mixed with paraffin wax to make sealing compositions for paper packaging materials.

The invention is illustrated by the following examples:

EXAMPLE 1

Twenty grams of an ethylene polymer of melt flow index 0.33 and specific gravity 0.922 were introduced into a flask which contained 100 grams of wax previously obtained by the thermal pyrolysis of the ethylene polymer. Steam was passed into the flask and from thence to a condenser. The temperature of the wax and polymer mixture was raised to 375°C and maintained at this temperature for 20 minutes.

Seven parts by weight of a soft grease with a pungent odour and a melting range 70°C to 82°C were obtained at the steam condenser.

One hundred and eleven parts by weight of residue remained in the flask. This was a colourless odourless wax of melting range 90°C to 100°C.

The process described in this example may readily be scaled up to pilot plant scale and then to industrial production scale.

EXAMPLE 2

One thousand grams of discarded packaging materials composed of an ethylene polymer of melt flow index 0.25 and specific gravity 0.925 were introduced into a vessel which contained 5000 grams of wax previously obtained by the thermal pyrolysis of the ethylene polymer. The temperature of the mass was raised to 400°C and a gentle stream of steam passed over the mass for 30 minutes.

Seventy two grams of a soft grease of pungent odour and melting range 56—68°C was obtained at the steam condenser. The residual wax in the vessel was allowed to cool. It was easily separated from the vessel when it had solidified. The mass of wax obtained was 5850 grams. The melting range of the wax was 98°C—100°C.

A suitable form of apparatus for carrying out the invention is illustrated in the accompanying drawing which is a cross-sectional diagrammatic view of a reaction vessel.

The drawing shows a reactor 1 provided with a hopper 2 and feeder 3 through which polyethylene pieces are supplied. There is a steam inlet 4 and a steam outlet 5 leading to a condenser (not shown). A burner 6 is provided beneath the reactor to heat the wax 7 and keep it molten in the reactor. A wax outlet 8 is provided at the side of the reactor. Alternatively, syphonic extraction means may be used to withdraw the wax from the reactor.

WHAT WE CLAIM IS:—

1. A process for the production of wax materials from polymers of ethylene in which the polymeric materials are pyrolysed at temperatures in excess of 350°C in an atmosphere of steam to produce soft greases, which are carried off in the steam, and wax materials.

2. A process according to Claim 1 which is carried out in a pyrolysis vessel charged with wax previously produced by the process, the wax being molten at the pyrolysis temperature.

3. A process according to Claim 2 wherein the polymeric materials are fed to the pyrolysis vessel, the pyrolysis takes place in the liquid wax phase and wax materials are withdrawn from the vessel.

4. A process according to Claim 3 wherein the wax materials are withdrawn from the vessel continuously through a valve.

5. A process according to any of the preceding Claims wherein the pyrolysis temperature is in the range 350°—500°C.

6. A process according to Claim 5 wherein the pyrolysis temperature is in excess of 375°C.

7. A process according to any of the preceding Claims wherein the time taken by the pyrolysis reaction is from 10 to 30 minutes.

8. A process according to any of the preceding Claims wherein the pyrolysis vessel is maintained at atmospheric pressure.

9. A process according to any of Claims 2—8 wherein the steam is passed continuously through the pyrolysis vessel.

10. A process according to any of the preceding Claims wherein the polymeric material is a polymer of ethylene commercially called low density polythene, the specific gravity of which is in the range of 0.90—0.94.

11. A process according to any of Claims 1—9 wherein the polymeric material is a polymer of ethylene commercially called high density polythene, the specific gravity of which is in the range 0.94—0.96.

12. A process according to any of the preceding Claims wherein the polymeric material is used or discarded packaging material.

13. A process for the production of wax materials substantially as described herein with reference to either of the Examples.

14. Apparatus for carrying out the process according to any of the preceding Claims, said apparatus comprising a raction vessel provided with a receiver portion for molten wax, a steam inlet and a steam outlet in

said reaction vessel disposed so as to permit the passage of steam across the receiver portion, a feeder inlet for charging the receiver portion with polymeric material, heating means for heating the material in the receiver portion and a wax outlet for withdrawing wax materials from the receiver portion.

15. Apparatus for carrying out the process according to any of the preceding Claims, said apparatus being substantially as described herein with reference to the drawing.

16. Wax material whenever produced by a process according to any of Claims 1—13 or using apparatus according to either of Claims 14 and 15.

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1450285 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*